Appendix A

Wetland Permanence Assessment Report

WETLAND PERMANENCE ASSESSMENT

FOR

"NORTHWEST CLAIRMONT AREA STRUCTURE PLAN"

Located between NE-02-073-06-W6M and SE-28-072-06-W6M, in the County of Grand Prairie, Alberta

Prepared for:

The County of Grand Prairie
Clairmont, Alberta

March 2017

WSP Ref.: 151-04424-00

WSP

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Prepared for:
The County of Grand Prairie
Clairmont, Alberta

Prepared by:
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March 2017

This report has been reviewed and approved for release by a professional biologist (R.P.Bio. / P.Biol.) and qualified wetland science practitioner (QWSP).

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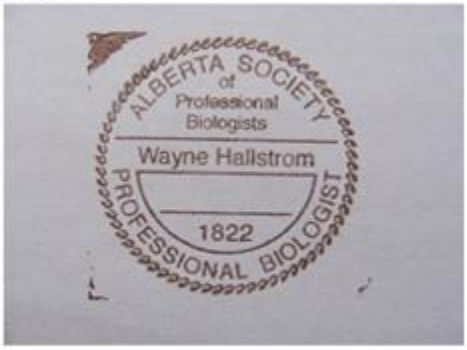

SIGNATURE:

Wayne Hallstrom, MSc, P.Biol, QAES/QWSP

WSP Ref.: 151-04424-00

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1.0 INTRODUCTION AND SUMMARY

1.1 Project Background and Location

This report presents findings of the wetland permanence assessment for the wetlands on lands for a proposed land development. The County of Grand Prairie No.1 is undertaking a proposed development in the Hamlet of Clairmont, Alberta. This is for an Area Structure Plan related to development of land for industrial and commercial purposes.

The development area is just west of Hwy 2 and north of TWP 724 within 26 quarter sections of land. The property surrounds watercourses and waterbodies defined by Alberta Environment and Parks (AEP), including wetlands, Ferguson Lake, and several other small Unnamed Tributaries to Grande Prairie Creek. The proposed development area will include conversion of active crop land for industrial and commercial development, as well as expansion of the current Clairmont Landfill. The County of Grande Prairie has determined it is necessary to develop an Area Structure Plan (Northwest Clairmont ASP), to facilitate the development. This construction is proposed to occur sometime after 2017. As part of the project, WSP Canada Inc. was retained to conduct a wetland assessment at the site the summer of 2016.

Current land use is predominantly crop and livestock farmland and landfill. Many watercourses exist on the property, as well as Ferguson Lake. The lake is 286 ha in size and is a mapped trumpeter swan waterbody (AEP LAT tool, 2016a). A tentative plan has been outlined to include general areas of development, however the County has not finalized the plans and has not discussed details with AEP, and therefore the entire site was assessed for water issues including Ferguson Lake and all other permanent and non-permanent, naturally occurring waterbodies watercourses and wetlands. No large forested areas were observed during air photo analysis.

1.2 Objectives

This document outlines the site environmental constraints relating to permanent waterbodies, and focuses specifically on the wetland permanence review aspect of wetland assessment. Wetland permanence review is required by AEP to establish land ownership boundaries relating to permanent bed-and-shore areas prior to land use planning and development. Ownership of those areas having permanent wetlands and waterbodies may be claimed by the Crown under the *Public Lands Act* and thus may not be available for development (AEP, 2016b).

The main objectives of field surveys were to determine whether any permanent waterbody biophysical characteristics of concern would be disturbed by construction, to calculate the area of all wetlands on the site that may be disturbed and related wetland compensation requirements, and for review of provincial Crown ownership of permanent waterbodies on the project property under the *Public Lands Act*.

As stated in the Alberta Wetland Policy directive regarding wetland permanence assessment (AEP *Guide to Assessing Permanence of Wetland Basins*, 2016b):

> *The Crown ownership claim to a wetland basin's bed-and-shore is limited to only those water features which meet the following criteria:*
>
> 1. ***The wetland must be a "body of water".*** *There is a distinct difference between ownership under the Public Lands Act and the regulatory provisions in the Water Act whose definition of a 'water body' includes "wetlands" as part of the definitions. The wetland basin must be more than land that is simply wet and generally must have a character and depth of ponds that support open water and associated aquatic vegetation.*
> 2. ***The wetland must be "naturally occurring".*** *The wetland feature must be of geomorphic origin and not a man-made landscape feature (e.g. a dugout, constructed wetland, etc.).*
> 3. ***The wetland must be "permanent" (or reasonably so).*** *The wetland must have persistent inundation period but need not be perpetually or continually inundated. Wetlands normally respond to changes in annual climate through a well-defined cycle and may from time to time become dry during periods of low precipitation followed by another period of inundation. Their boundaries will vary over time as well[A].*
>
> [A] *as a permanent and naturally occurring body of water",* ***the wetland must have a boundary that can be clearly defined which separates one landowner from another.*** *In Alberta, water body ownership boundaries are legally defined under Section 17 of the Surveys Act as a "bank" that represents the limit or extent of the bed-and-shore of that water body. A distinct change in vegetation is one of the primary determinants in defining this boundary. As wetlands commonly have multiple vegetation community types aligned along a moisture gradient, many changes in vegetation can be represented. For the purpose of determining the "ownership boundary" of the Crown-claimable wetland, the provincial Crown normally considers the upland boundary of the emergent aquatic plant community to be the boundary delineating the body of water under Section 3 of the Public Lands Act.*

Wetland assessment and classification is used to assist in evaluation of wetland permanence and determination of wetland versus upland ownership boundaries. Wetland permanence assessment requires specialized skills and experience, and a high degree of care attention and accuracy must be applied to minimize liability and avoid litigation. The assessor must be or be under the guidance of a certified professional (e.g. biologist, agrologist, etc.) who is a member of a Professional Regulatory Organization (e.g. Alberta Society of Professional Biologists, Alberta Institute of Agrologists, etc.) and having suitable skills and training with aerial photo interpretation, geomorphology, botany, and wetland ecology.

1.3 Summary

On the basis of desktop analysis for wetlands and watercourses using air photo interpretation for a variety of years, 153 actual and potential wetlands and one watercourse with multiple branches connecting in several areas across the site were found within the area boundaries (Figure 1; Appendix A).

Eleven (11) of these wetlands appear to potentially be permanent waterbodies as defined by AEP standards. Analysis of historical airphotos showed the wetlands are consistently present in the majority of seasons and years, and field data confirmed the presence of wetland soils, water and vegetation indicators consistent with the classification of these wetlands as permanent. The County has yet to finalize plans for the area and therefore we are treating the site as if all wetlands will be disturbed/infilled during construction for industrial and commercial use. Determination of whether these wetland sites are claimed by the Crown under the *Public Lands Act* is required to provide certainty to the planning process going forward.

This report relates information about wetland permanence and initiates review by AEP for assessment of provincial Crown-claimability under the *Public Lands Act* review process.

2.0 STUDY AREA

2.1 Project Location

The project area is located in the Hamlet of Clairmont, Alberta west of Highway 2 and north of TWP 724 surrounding Ferguson Lake. The legal land description is several quarter sections within 72-06 W6M and 73-06 W6M (Figure 1). The project boundary overlaps 27 quarter sections, including the lake, within the following quarter sections:

NW 26-072-06-W6M	NE 33-072-06-W6M	
SW 26-072-06-W6M	SE 33-072-06-W6M	NW 02-073-06-W6M
NE 26-072-06-W6M	NW 34-072-06-W6M	SW 02-073-06-W6M
SE 26-072-06-W6M	SW 34-072-06-W6M	NE 02-073-06-W6M
NW 27-072-06-W6M	NE 34-072-06-W6M	SE 02-073-06-W6M
SW 27-072-06-W6M	SE 34-072-06-W6M	SW 03-073-06-W6M
NE 27-072-06-W6M	NW 35-072-06-W6M	SE 03-073-06-W6M
SE 27-072-06-W6M	SW 35-072-06-W6M	SE 04-073-06-W6M
NE 28-072-06-W6M	NE 35-072-06-W6M	
SE 28-072-06-W6M	SE 35-072-06-W6M	

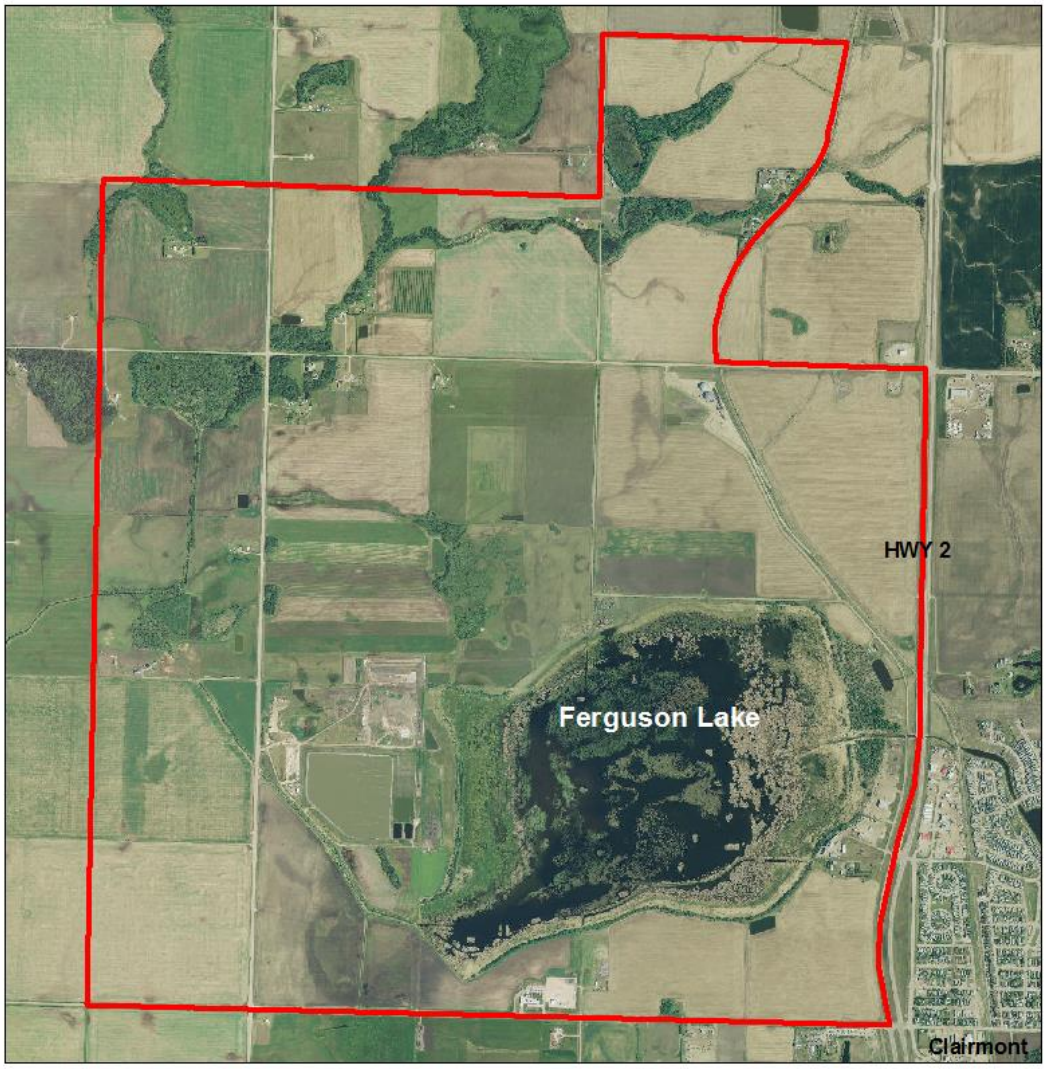

Figure 1. Project boundary of wetland assessment area.

The Northwest Clairmont ASP is located within the Parkland Natural Region of Alberta, and within the Peace River Parkland Subregion (Figure 2).

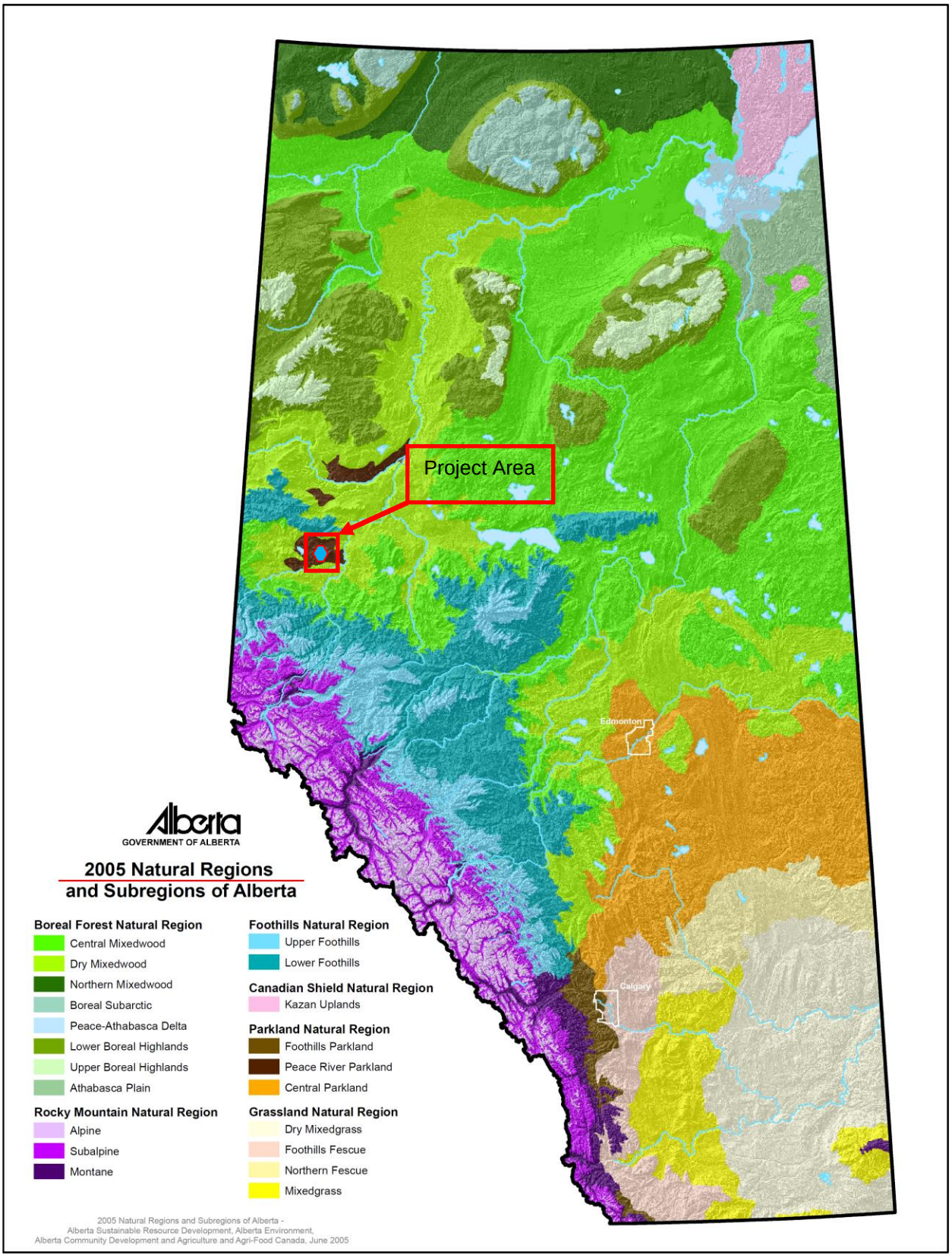

Figure 2. Map of natural subregions of Alberta (Natural Regions Committee 2006).

3.0 METHODS

3.1 Background Information

General environmental information was compiled from existing maps, non-governmental sources, and government databases (Alberta Conservation Information Management System [ACIMS] 2016; Fisheries and Wildlife Management Information System [FWMIS] 2016; Agricultural Regions of Alberta Soil Inventory Database [AGRASID] - Alberta Agriculture and Rural Development 2008, AEP Landscape Analysis Tool [AEP LAT, 2016a], Alberta Merged Wetland Inventory [AMWI – Alberta Environment, 2014], etc.). This information was brought into a Geographic Information System (GIS) application or reviewed concurrently examining these data for overlaps with the project wetland location(s).

3.1.1 Land Unit Classification and Mapping

Land units were initially delineated by interpretation of aerial photographs. Native vegetation both in wetlands and on the site was noted and identified for delineation purposes.

The AMWI data (AEP, 2014) had a generalized inventory layer of GIS mapping data for wetlands in the Northwest Clairmont area, including classifications based on satellite imagery and remote sensing. This was used for overview and was confirmed with detailed airphoto review and field surveys.

3.1.2 Soils

A desktop review of available soils and vegetation data was conducted using AGRASID (Alberta Agriculture and Rural Development 2008, Internet Site).

3.2 Regional Climate Data

3.2.1 Environment Canada

Climate data are available online (Environment Canada, 2015). This data was downloaded, screened, reviewed and plotted to allow examination of inter-year precipitation variability that may influence wetland characteristics observed.

3.2.2 Alberta Agriculture and Forestry – Climate Atlas Maps

Alberta Climate Information Services (ACIS) data are conveniently presented in map format online (Alberta Agriculture and Forestry, 2016). This data was reviewed via the online mapping function to allow examination of inter-year precipitation variability that may influence wetland characteristics observed.

3.3 Wetland Extent

Whenever possible, analysis was focused on wet conditions and the growing season. Early season (spring and early summer) and late season (late summer or fall) timing of images was preferred when available, to provide greatest chance to observe wetland conditions relating both to maximal wetland extent in flood conditions and to annual inundation permanence through into the late summer and fall.

3.3.1 Review of Current and Historical Aerial Photos and Satellite Images

Prior to field surveys current and historical airphotos were examined to create preliminary mapping of potential wetland areas. Historical airphotos and images (1950, 1952, 1961, 1974, 1975, 1979, 1982, 1988, 1989, 1995, 2000, 2003-05, 2003-08, 2005, 2006-08, 2006-10, 2010, 2012-05, 2012-07, 2013-09, and 2014 – covering both high and low runoff/precipitation years) were examined using GIS mapping to identify and define the extent of site wetlands due to inter-year variability in presence, size and variable airphoto quality (Appendix A & B). All potential wetland locations observed across all airphoto-years were mapped, and all potential wetland sites were subsequently examined in the field using printed field maps with an overlaid GPS grid for reference.

3.3.2 Field survey

Field surveys for wetlands were conducted June 15-19th and August 17th, 2016. Each potential wetland identified in the preliminary airphoto interpretation screening maps was visited in the field to determine current status. Data about soils, vegetation, water chemistry and landscape context were recorded to further define wetland extent and characteristics for classification purposes. All wetlands or portions of wetland observed during field surveys (including 'ephemeral marsh' areas [Stewart and Kantrud Class I]) were delineated and recorded. Field survey of vegetation identification in each potential wetland site was used for delineation since many plants are considered good indicators of wetland extent due to their specific growing needs (Wetland Institute 1987; Tiner 1999). Soil sampling to confirm wetland soils was done as an additional secondary method at each wetland as confirmation, and as a primary assessment method where clearing for crops was present, where wetland plants did not provide sufficient delineation ability, or where there was question about wetland classification. All wetlands were field-mapped and/or GPS-mapped to provide the best estimate of wetland areas for planning purposes. Wetland classifications followed the Alberta Wetland Classification System (AWCS) from Alberta Environment and Sustainable Resource Development (ESRD, 2015).

Other important site characteristics such as beaver activity, anthropogenic impoundments, roads, ditching, misplaced culverts, constructed wetlands/stormponds/dugouts/channels, leaking irrigation infrastructure or any other natural and unnatural features that may contribute to a given wetland being present or modifying the size, extent or duration of inundation were recorded for consideration.

3.3.3 Wetland Inventory Classification

The AWCS (ESRD, 2015) was used to categorize all the natural wetlands on the property. This system is based upon the Alberta Wetland Inventory Classification System (Halsey et al, 2003), Wetlands of Canada and the Canadian Wetland Classification System (National Wetlands Working Group 1988, 1997), and the prairie wetlands system of Stewart and Kantrud (1971). A combination of vegetation, soils and biogeoclimatic data are used for the new AWCS classification.

The AMWI data (AEP, 2014) had a generalized inventory layer of GIS mapping data for wetlands in the Northwest Clairmont area, including classifications based on satellite imagery and remote sensing. This was used for overview and was confirmed with field surveys.

3.3.4 Wetland ABWRET rating

Wetland mapping, classifications data and Alberta Wetland Rapid Evaluation Tool – Actual (ABWRET-A) table data was sent to AEP to obtain their ABWRET ratings for wetland quality (A, B, C, D quality rating).

3.4 Wetland Permanence

The above information was compiled for each wetland, and reviewed in order to delineate and classify each wetland for purpose of wetland permanence categorization. A table summarizing wetland classification and likely classification of Wetland permanence was prepared for AEP review purposes (Appendix B; AEP, 2016b).

4.0 RESULTS - BASELINE CONDITIONS

4.1 Background Information

4.1.1 Land Use and Vegetation

The assessment area potentially affected by the project (approximately 1639.45Ha) is a combination of native watercourse and wetland areas (approximately 100.02 Ha [6.1%] and 415.9 Ha [25.4%] of total lands respectively), landfill and wastewater treatment operations (approximately 59.83 Ha [3.7%] of total lands), and active farmland that has been previously cleared for agricultural purposes and has little or no native vegetation remaining (approximately 1063.70 Ha [64.9%] of total lands). Historical land use at the site during the past 50 years has included development work for tillage for cereal and seed crops, fallow land, pasture for livestock, roadway/highway, and landfill (airphoto review). Farmlands affected by the proposed development project are not considered prime habitat, as very few animal species live in these sites due to their open nature, there is low habitat structural diversity, and the site has seen frequent major disturbances. Plant diversity in the farmed areas at the site is also relatively low, due to a combination of tilling and seeding with agronomic species, weed control, and haying. Native forested and wetland areas have higher plant diversity and are considered good habitat and connectivity for wildlife.

Digital GIS mapping showed the AMWI wetlands inventory data layer (AEP, 2014) depicted a total of 381.94 Ha of wetlands were located on the project lands in the Northwest Clairmont area (Appendix C). This roughly aligns with the results of the project wetland assessment, (airphoto interpretation and field surveys); with a greater area of wetlands identified during the current assessment likely being due to greater resolution provided by the methods used relative to the AMWI methods.

4.1.2 Soils

A desktop review of available soils and vegetation data was conducted using AGRASID and the results are in Table 1 (Alberta Agriculture and Rural Development 2008, Internet Site). The site is defined by the Alberta government as within the Parkland Natural Region of Alberta, and within the Peace River Parkland Subregion (Natural Regions Committee, 2006; Achuff, 1996). The federal ecological classification is Boreal Mixedwood - Dry Mixedwood natural subregion, and lists soils for the area being dominated by Organic, Gray Luvisols, Brunisols, Gleysols and to a lesser extent Cryosols in the northernmost regions (Beckingham and Archibald, 1996). Orthic Gray, Brunisolic Gray, Gleyed Gray and Dark Gray Luvisols and all common, with Gleysolic and Organic soils where drainage is inhibited, and Regosols found where tough conditions or frequent strong disturbances occur such as along watercourses (Beckingham and Archibald, 1996).

The Alberta soil classification mapping has the best resolution for the region, and the AGRASID soil landscape model for this large site property shows the a wide variety of soil types, with frequent presence of 'Miscellaneous water', gleyed soils, and poor drainage indicating likely presence of wetlands (Alberta Agriculture and Rural Development 2008, Internet Site; Table 1; Figure 3; Appendix D).

Table 1. Soil characteristics summary for the project area.

Polygon	Component	Soil group	Description	Drainage	Wetland?
22373	1	water	water	Poor	Yes
22346	1	GLSZ.BLC	Gleyed solonozetic black chernozoems	-	Likely
	2	O.HG	Orthic humic gleysol	Poor	Likely
22312	1	GLBL.SZ	Gleyed black solonozetic	-	Likely
22343	1	GLSZ.BLC	Gleyed solonozetic black chernozoems	Moderately well	Likely
22314	1	GLBL.SZ	Gleyed black solonozetic	Moderately well	Likely
	2	GLSZ.BLC	Gleyed solonozetic black chernozoems	Moderately well	Likely
22317	1	SZ.BLC	Solonozetic black chernozoems	Moderately well	
22345	1	GLSZ.BLC	Gleyed solonozetic black chernozoems	Moderately well	Likely
	2	O.HG	Orthic humic gleysol	Poor	Likely
22333	1	SZ.BLC	Solonozetic black chernozoems	Moderately well	
	2	GLSZ.BLC	Gleyed solonozetic black chernozoems	Moderately well	Likely

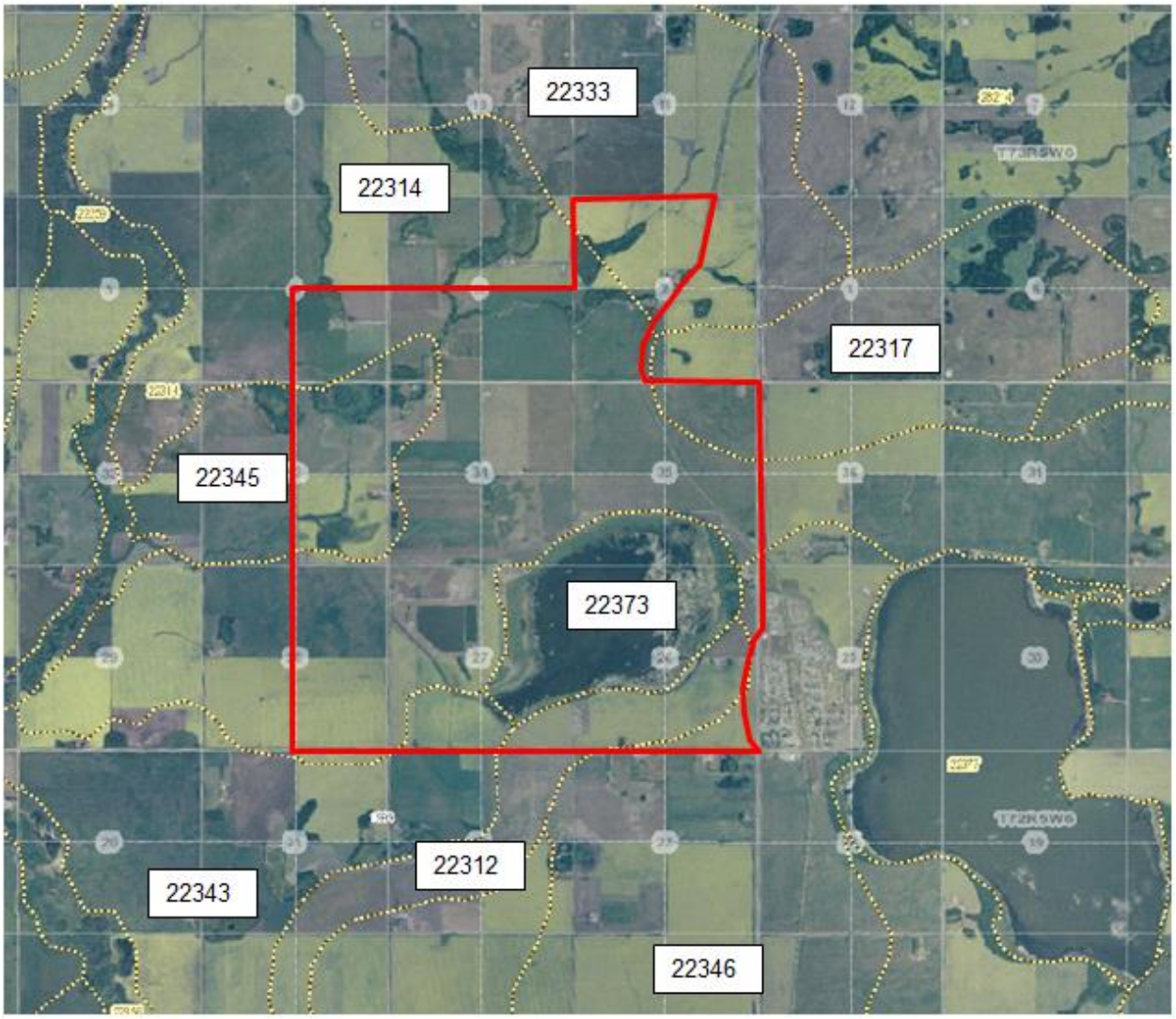

Figure 3. Landform profile and soil type distributions.

4.2 Environment Canada – Regional Climate Data

Climate data (Environment Canada, 2015; AAF and AEP, 2016) reviewed and plotted showed inter-year precipitation variability that may influence wetlands (Figure 4). Not all time periods have airphotos available for review, but in general years with wetter conditions were chosen for the assessment.

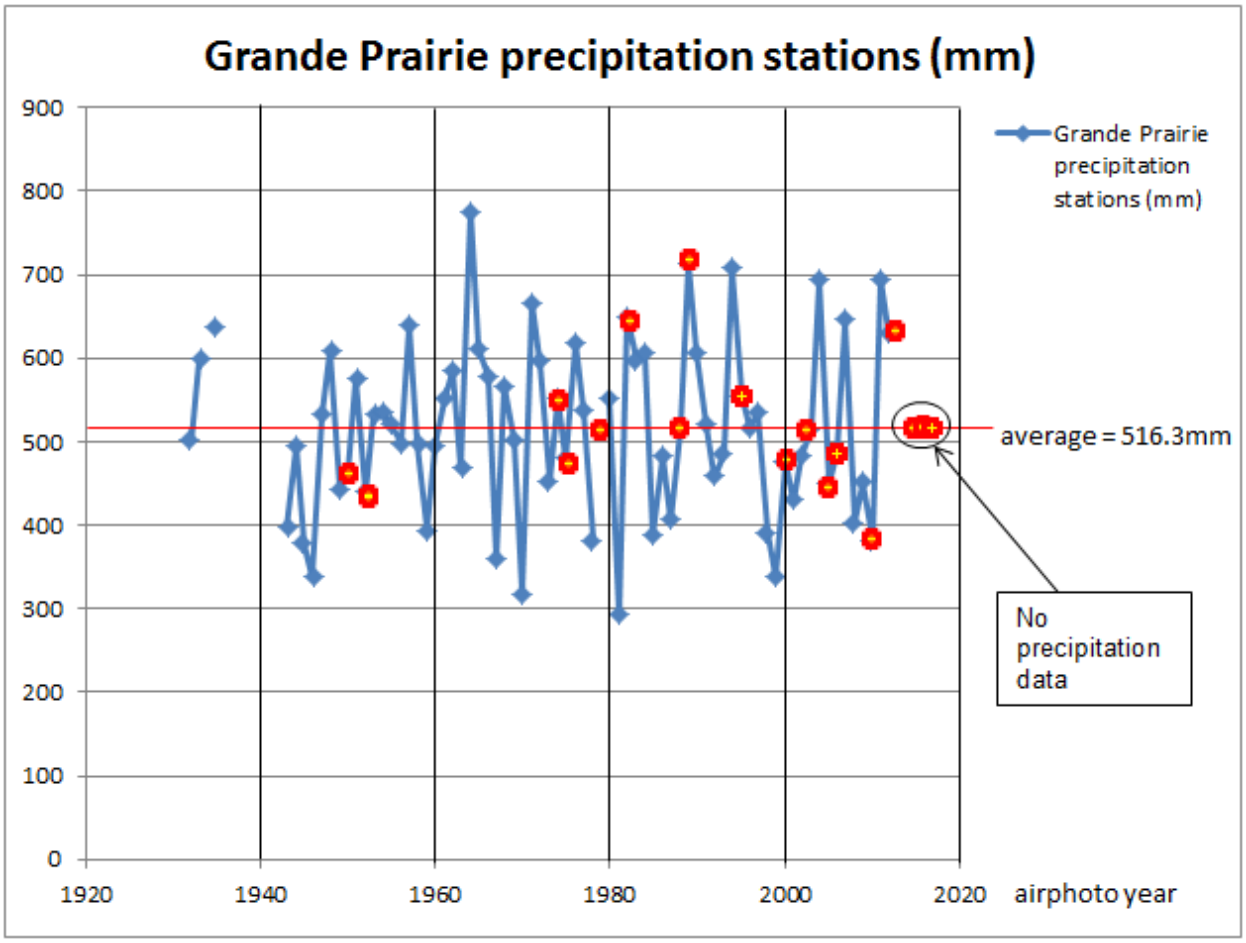

Figure 4. Climatic variability for the project region, showing dates of airphotos used for assessment purposes ( ).

4.3 Wetland Extent

Historical (airphoto) and current (field survey) wetland extent estimations were combined for analysis. There were eleven (11) potentially 'permanent' wetlands identified on the site.

4.3.1 Review of Current and Historical Aerial Photos and Satellite Images

Effort was made to fully delineate and catalogue wetlands. The extent of some wetlands can vary in size substantially due to high inter-year variability. The method of using multiple years of airphotos for comparative purposes covered both high and low runoff/precipitation years while identifying and defining wetlands.

Twenty-two (22) airphotos spanning the period 1950-08, 1952-09, 1961-05, 1974-07, 1975-05, 1979-06, 1982-05, 1988-10, 1989-09, 1995-09, 2000-10, 2003-05, 2003-08, 2005-09, 2006-08, 2006-10, 2010-05, 2012-05, 2012-07, 2013-09, 2014-06 and 2014-07 (covering both high and low runoff/precipitation years)

were analysed in GIS, with relatively high consistency of results. Not all airphotos had available coverage for all years – only thirteen had coverage sufficient for use across the site as part of this permanence analysis (1950-08, 1974-07, 1988-10, 1995-09, 2000-10, 2005-09, 2006-08, 2010-05, 2012-05, 2012-07, 2013-09, 2014-06, 2014-07). Maps of each permanent wetland are available (Appendix A).

Eleven (11) potentially permanent wetland sites were identified based on airphoto interpretation and field data and were in most years found to be complexes of open water, marsh and swamp (Appendix B - Wetland permanence assessment Table). Examination of the AEP Alberta Merged Wetland Inventory confirmed the rough location and classification typing (Appendix C).

4.3.2 Field survey

Permanent wetlands located on the project lands and on adjacent lands surrounding the property are open water, marsh and swamp-type wetlands. Field data confirmed the categorization and provided further data to support assessment of wetlands as permanent (Table 2).

4.3.2.1 Field Surveys

Wildlife

No detailed species-specific searches for eggs, nests, hibernacula or dens were conducted. However several species of concern have been observed from the area historically. FWMIS records showed one species of concern within the vicinity of the project – peregrine falcon (Appendix E). The AEP Landscape Analysis Tool (LAT) layers show Ferguson Lake and Clairmont Lake are defined as Trumpeter Swans breeding habitat.

Some tracks were found, and wildlife such as ungulates are expected to use the area for passage. No wildlife observations were recorded during field surveys. AEP review will tell whether further surveys for wildlife may be needed to meet AEP requirements for confidence in determining whether the above noted species are found on the property or in the surrounding area. Additional surveys may need to be completed prior to clearing and construction activities, to remain in compliance with the Alberta *Wildlife Act* and the federal *Migratory Bird Convention Act* (c.1994).

Vegetation

Further analysis by means of field surveys June 15-19th and August 27th, 2016 identified and delineated current extent of the wetlands on the property. Wetlands on the property that are considered 'permanent' were in relatively good condition and frequency of water inundation makes them largely undevelopable. The dominant species cover in the wetlands is listed in Table 2. A generalized list of site vegetation is in Appendix F.

Table 2. Wetland Vegetation Indicators by Wetland

Wetland Number	Wetland Indicator Species Scientific Name	Wetland Species Common Name	Stewart & Kantrud (1971) Class	Wetland classification
33	*Lemna minor* *Eleocharis palustris* *Polygonum amphibium* *Carex aquatilis* *Carex utriculata* *Carex atheroides* *Equisetum* *Glyceria grandis* *Phleum pratense* *Phalaris arundinacea* *Poa palustris* *Populus balsamifera* *Ranunculus sceleratus* *Scirpus spp* *Salix spp* *Potemageton pusillus* *Typha spp* *Urtica dioica*	duckweed Common spikrush Water smartweed Water sedge Beaked sedge Awned sedge Horsetail Tall manna grass Timothy grass Reed canary grass Fowl bluegrass Poplar Celery-leaved buttercup Bulrush Willow Pondweed Cattail Stinging nettle	4 2, 3 3 3, 4 3, 4 3, 4 2 3, 4 1 2 2 1, 2 3 4 2, 3 4 4 2	Seasonal shrubby swamp And Seasonal graminoid marsh And * Semi-permanent graminoid marsh (mixed)
18	*Thlapsi arvense* *Ranunculus sceleratus* *Fragaria vesca* *Rumex occidentalis* *Mentha spicata* *Urtica dioica* *Stellaria media* *Phleum pratensis* *Carex disperma* *Typha spp* *Eleocharis palustris* *Phalaris arundinacea* *Salix spp* *Cornus canadensis*	Stinkweed Marsh buttercup Strawberry Western dock Mint Stinging nettle Chickweed Timothy Two-seeded sedge Cattail Common spike rush Reed canary grass * Willow * Dogwood	2 3 2 2, 3 2 2 1, 2 1, 2 3 3, 4 2, 3 2 2, 3 2, 3	Seasonal shrubby swamp And Seasonal graminoid marsh And * Semi-permanent graminoid marsh (mixed)
12	Not sampled	Not sampled	Not sampled	* Shallow open water, permanent And Semi -permanent graminoid marsh (mixed)

14	*Petasites saggitarius*	Arrow-leaved coltsfoot	2, 3	Seasonal shrubby swamp And * Semi-permanent graminoid marsh (mixed)
	Equisetum spp	Horsetail	2, 3	
	Calamagrostis spp		2, 3	
	Phaliaris arundinacea	Reed canary grass	2, 3	
	* *Carex spp*	Unknown sedge (tall)	3, 4	
	Typha spp	Cattail	3, 4	
	Carex utriculata	Beaked sedge	3, 4	
	Salix spp	Willow	2, 3	
101	*Lemna minor*	duckweed	4	Seasonal shrubby swamp And Semi-permanent graminoid marsh And * Shallow open water, semi-permanent to permanent (mixed)
	Ceratophyllum demersum	coontail	4, 5	
	Eleocharis palustris	Common spikrush	2, 3	
	Polygonum amphibium	Water smartweed	3	
	Carex aquatilis	Water sedge	3, 4	
	Carex utriculata	Beaked sedge	3, 4	
	Carex atheroides	Awned sedge	3, 4	
	Equisetum	Horsetail	2	
	Glyceria grandis	Tall manna grass	3, 4	
	Phleum pratense	Timothy grass	1	
	Phalaris arundinacea	Reed canary grass	2	
	Poa palustris	Fowl bluegrass	2	
	Populus	Poplar	1, 2	
	Ranunculus sceleratus	Celery-leaved buttercup	3	
	Scirpus spp	Bulrush	4	
	Salix spp	Willow	2, 3	
	Potemageton pusillus	Pondweed	4	
	Typha spp	Cattail	4	
	Urtica dioica	Stinging nettle	2	
	water	water	4+	
102	*Beckmannia syzegachine*	Sloughgrass	3	Seasonal shrubby swamp And * Semi-permanent graminoid marsh (mixed)
	Hordeum jubatum	Foxtail barley	2, 3	
	Deschampsia spp	Hairgrass	2	
	Poa palustris	Fowl bluegrass	2	
	Lemna minor	Duckweed	4	
	Populus balsamifera	Poplar	2	
	Eleocharis palustris	Spikerush	3	
	Polygonum amphibium	Water smartweed	3	
	Carex aquatilis	Water sedge	3, 4	
	Carex utriculata	Beaked sedge	3, 4	
	Carex atheroides	Awned sedge	3, 4	
	Equisetum spp	horestail	2, 3	
	Glyceria grandis	Tall manna grass	3	
	Phleum pratense	Timothy	2	
	Phalaris arundinacea	Reed canary grass	2	
	Ranunculus sceleratus	Celery-leaved buttercup	2	

	Salix spp	Willow	2, 3	
	Potemageton pusillus	Pondweed	4	
	Typha spp	Cattail	4	
	Urtica dioica	Stinging nettle	2	
103	*Alopecurus geniculatus*	Water foxtail	2, 3	Seasonal shrubby swamp And Seasonal graminoid marsh And * Semi-permanent graminoid marsh (mixed)
	Hordeum jubatum	Foxtail barley	2	
	Cirsium arvense	Canada thistle	2	
	Equisetum	Horsetail	2,3	
	Salix spp	Willow	2, 3	
	Juncus bufonia	Toad rush	2, 3	
	Eleocharis palustris	Spike rush	2, 3	
	Typha latifolia	Cattail	4	
	Juncus balticus	Baltic rush	2, 3	
	Ranunculus sceleratus	Celery-leaved buttercup	2, 3	
	Plantago	Plantain	2	
	Polygonum apmhibium	Water smartweed	3	
	Rumex maratimus	Golden dock	3	
	Rumex occidentalis	Western dock	2, 3	
	Thlapsi arvensis	Stinkweed	2	
	Carex (aquatilis?)	Large sedge (water sedge?)	3, 4	
104	*Lemna minor*	duckweed	4	Seasonal shrubby swamp And Semi-permanent graminoid marsh And * Shallow open water, semi-permanent to permanent (mixed)
	Ceratophyllum demersum	coontail	4, 5	
	Eleocharis palustris	Common spikrush	2, 3	
	Polygonum amphibium	Water smartweed	3	
	Carex aquatilis	Water sedge	3, 4	
	Carex utriculata	Beaked sedge	3, 4	
	Carex atheroides	Awned sedge	3, 4	
	Equisetum	Horsetail	2	
	Glyceria grandis	Tall manna grass	3, 4	
	Phleum pratense	Timothy grass	1	
	Phalaris arundinacea	Reed canary grass	2	
	Poa palustris	Fowl bluegrass	2	
	Populus	Poplar	1, 2	
	Ranunculus sceleratus	Celery-leaved buttercup	3	
	Scirpus spp	Bulrush	4	
	Salix spp	Willow	2, 3	
	Potemageton pusillus	Pondweed	4	
	Typha spp	Cattail	4	
	Urtica dioica	Stinging nettle	2	
	water	water	4+	
105	*Lemna minor*	duckweed	4	Seasonal shrubby swamp And
	Petasites saggitarius	Arrow leaved coltsfoot	2	
	Eleocharis palustris	Common spikrush	2, 3	
	Polygonum amphibium	Water smartweed	3	

	Carex (aquatilis?)	Large sedge (Water sedge?)	3, 4	Seasonal graminoid marsh And * Semi-permanent graminoid marsh (mixed)
	Carex utriculata	Beaked sedge	3, 4	
	Carex atheroides	Awned sedge	3, 4	
	Equisetum	Horsetail	2	
	Glyceria grandis	Tall manna grass	3, 4	
	Phleum pratense	Timothy grass	1	
	Phalaris arundinacea	Reed canary grass	2	
	Poa palustris	Fowl bluegrass	2	
	Populus	Poplar	1, 2	
	Ranunculus sceleratus	Celery-leaved buttercup	3	
	Scirpus spp	Bulrush	4	
	Salix spp	Willow	2, 3	
	Potemageton pusillus	Pondweed	4	
	Typha spp	Cattail	4	
	Urtica dioica	Stinging nettle	2	
35	*Lemna minor*	duckweed	4	Seasonal shrubby swamp And Semi-permanent graminoid marsh And * Shallow open water, semi-permanent to permanent (mixed)
	Eleocharis palustris	Common spikrush	2,3	
	Polygonum amphibium	Water smartweed	2, 3	
	Carex (aquatilis?)	Large sedge (Water sedge?)	3	
	Carex utriculata	Beaked sedge	3, 4	
	Carex atheroides	Awned sedge	3, 4	
	Equisetum	Horsetail	2, 3	
	Phleum pratense	Timothy grass	2	
	Phalaris arundinacea	Reed canary grass	2	
	Poa palustris	Fowl bluegrass	2	
	Populus	Poplar	2	
	Salix spp	Willow	2, 3	
	Urtica dioica	Stinging nettle	2	
	water	water	4+	
28	*Taraxicum officinale*	Dandelion	1, 2	Seasonal shrubby swamp And Semi-permanent graminoid marsh And * Shallow open water, semi-permanent to permanent (mixed)
	Cirsium arvense	Canada thistle	1, 2	
	Ranunculus sceleratus	Northern buttercup	2, 3	
	Carex (aquatilis?)	Large sedge (Water sedge?)	3	
	Carex utriculata	Beaked sedge	3, 4	
	Typha latifolia	cattail	3, 4	
	Equisetum	Horsetail	2, 3	
	Bromus inermis	Smooth brome	2	
	Phalaris arundinacea	Reed canary grass	2	
	Poa pratensis	Kentucky bluegrass	2	
	Populous temuloides	Trembling aspen	1, 2	
	Populus balsamifera	Poplar	1, 2	
	Salix spp	Willow	2, 3	
	Urtica dioica	Stinging nettle	2	
	Rumex occidentalis	Western dock	2. 3	

ACMIS records showed no plant and invertebrate species of concern have been historically observed within the vicinity of the project (Appendix G). Detailed rare plant surveys were not conducted.

4.3.3 Wetland Inventory Classification

Wetlands were classified according to biophysical type based on ESRD (2015).

4.3.3.1 Wetland Inventory Classification Results

Eleven (11) 'permanent' wetlands (Class IV and higher) currently exist on the site based on the combination of the airphoto assessment (Appendix A) with detailed ground-truthing by field surveys. Wetlands Semi-Permanent (Class IV) and higher potentially need an AEP *Public Lands Act* review regarding Crown-claimability.

Additionally, development within any wetlands on the site will require a *Water Act* application for wetland infill, and compensation payments will be required for infilling any wetland of Temporary (Class II) or higher (AEP, 2015).

Wetland 1 (Site #33)

This wetland showed soils with evidence of wetland soils and dominance in deeper portions of the basin by graminoid and shrubby wetland-associated plants. Characteristics were consistent with a complex of 'Swamp, Shrubby, Seasonal, Freshwater (S-S-III-f))', and 'Marsh, Graminoid, Semi-permanent, Freshwater (M-G-IV-f)' wetland under the AWCS (ESRD, 2015; Class IV Marsh in the Stewart & Kantrud Wetland Classification System, 1971). Classification goes to the deepest part of the wetland - (M-G-IV-f).

The AMWI data incorrectly identified this wetland area as 100% swamp while it is actually a marsh and swamp complex (Appendix C). The field data indicates a marsh and swamp complex wetland type due to the presence of wetland vegetation indicators of these wetland types. This wetland drains directly into regional watercourse feature (Unnamed Tributary to Grande Prairie Creek).

Wetland 2 (Site #18)

This wetland showed soils with evidence of wetland soils and dominance in deeper portions of the basin by graminoid and shrubby wetland-associated plants. Characteristics were consistent with a complex of 'Swamp, Shrubby, Seasonal, Freshwater (S-S-III-f)', 'Marsh, Graminoid, Seasonal, Freshwater (M-G-III-f)' and 'Marsh, Graminoid, Semi-permanent, Freshwater (M-G-IV-f)' wetland under the AWCS (ESRD, 2015; Class IV Marsh in the Stewart & Kantrud Wetland Classification System, 1971). Classification goes to the deepest part of the wetland - (M-G-IV-f).

The AMWI data correctly identified this wetland area as a marsh and swamp complex, although the wetland locations from the AWMI were not well-aligned to the actual swamp and marsh locations found in field surveys and detailed airphoto review (Appendix C). The field data indicates a marsh and swamp

complex wetland type due to the presence of wetland vegetation indicators of these wetland types. This wetland does not appear to be part of regional watercourse drainage (Unnamed Tributary to Grande Prairie Creek).

Wetland 3 (Site #12 – Ferguson Lake)

This wetland showed soils with evidence of wetland soils and dominance for the majority of the basin by graminoid wetland-associated plants and open water. Characteristics were consistent with a complex of 'Swamp, Shrubby, Seasonal, Freshwater (S-S-III-f))', 'Marsh, Graminoid, Semi-permanent, Freshwater (M-G-IV-f)', and 'Shallow open water, Aquatic submersed/floating vegetation, Permanent, Slightly brackish (W-A-V-sb)' pond wetland under the AWCS (ESRD, 2015; Class V Marsh in the Stewart & Kantrud Wetland Classification System, 1971). Classification goes to the deepest part of the wetland - (W-A-V-sb).

The AMWI data correctly identified this wetland area as an open water, marsh and swamp complex, although locations of each type differed between the AMWI, airphoto-years and field survey (Appendix C). The field data indicates a marsh and swamp complex wetland type due to the presence of wetland vegetation indicators of these wetland types. This wetland is major and permanent part of regional watercourse drainage (Unnamed Tributary to Grande Prairie Creek).

Wetland 4 (Site #14)

This wetland showed soils with evidence of wetland soils and dominance for the majority of the basin by graminoid and shrubby wetland-associated plants. Characteristics were consistent with a complex of 'Swamp, Shrubby, Seasonal, Freshwater (S-S-III-f))' and 'Marsh, Graminoid, Semi-permanent, Freshwater (M-G-IV-f)' wetland under the AWCS (ESRD, 2015; Class IV Marsh in the Stewart & Kantrud Wetland Classification System, 1971). Classification goes to the deepest part of the wetland - (M-G-IV-f).

The AMWI data correctly identified this wetland area as a marsh and swamp complex, although locations of each type differed between the AMWI, airphoto-years and field survey (Appendix C). The field data indicates a marsh and swamp complex wetland type due to the presence of wetland vegetation indicators of these wetland types. This wetland is part of regional watercourse drainage (Unnamed Tributary to Grande Prairie Creek).

Wetland 5 (Site #101)

Wetland 101 and Wetland #105 are connected hydrologically by a culvert. Significant flows were observed from Wetland #101 into Wetland #105 during the June 2016 field surveys.

This wetland showed soils with evidence of wetland soils and dominance for the majority of the basin by graminoid wetland-associated plants and open water. Characteristics were consistent with a complex of 'Swamp, Shrubby, Seasonal, Freshwater (S-S-III-f))', 'Marsh, Graminoid, Semi-permanent, Freshwater

(M-G-IV-f)', and 'Shallow open water, Aquatic submersed/floating vegetation, Permanent, Slightly brackish (W-A-V-sb)' pond wetland under the AWCS (ESRD, 2015; Class V Marsh in the Stewart & Kantrud Wetland Classification System, 1971). Classification goes to the deepest part of the wetland - (W-A-V-sb).

The AMWI data incorrectly identified this wetland area as a swamp, while airphoto interpretation and field surveys showed it also had a large central component of marsh (Appendix C). The field data indicates a marsh and swamp complex wetland type due to the presence of wetland vegetation indicators of these wetland types. This wetland is part of regional watercourse drainage (Unnamed Tributary to Grande Prairie Creek).

Wetland 6 (Site #102)

This wetland showed soils with evidence of wetland soils and dominance for the majority of the basin by graminoid and shrubby wetland-associated plants. Characteristics were consistent with a complex of 'Swamp, Shrubby, Seasonal, Freshwater (S-S-III-f))' and 'Marsh, Graminoid, Semi-permanent, Freshwater (M-G-IV-f)' wetland under the AWCS (ESRD, 2015; Class IV Marsh in the Stewart & Kantrud Wetland Classification System, 1971). Classification goes to the deepest part of the wetland - (M-G-IV-f).

The AMWI data correctly identified this wetland area as a marsh and swamp complex, although locations of each type differed between the AMWI, airphoto-years and field survey (Appendix C). The field data indicates a marsh and swamp complex wetland type due to the presence of wetland vegetation indicators of these wetland types. This wetland is part of regional watercourse drainage (Unnamed Tributary to Grande Prairie Creek).

Wetland 7 (Site #103)

This wetland showed soils with evidence of wetland soils and dominance for the majority of the basin by graminoid and shrubby wetland-associated plants. Characteristics were consistent with a complex of 'Swamp, Shrubby, Seasonal, Freshwater (S-S-III-f))', 'Marsh, Graminoid, Seasonal, Freshwater (M-G-III-f)' and 'Marsh, Graminoid, Semi-permanent, Freshwater (M-G-IV-f)' wetland under the AWCS (ESRD, 2015; Class IV Marsh in the Stewart & Kantrud Wetland Classification System, 1971). Classification goes to the deepest part of the wetland - (M-G-IV-f).

The AMWI data correctly identified this wetland area as a marsh and swamp complex, although locations of each type differed between the AMWI, airphoto-years and field survey (Appendix C). The field data indicates a marsh and swamp complex wetland type due to the presence of wetland vegetation indicators of these wetland types. This wetland is part of regional watercourse drainage (Unnamed Tributary to Grande Prairie Creek).

Wetland 8 (Site #104)

This wetland showed soils with evidence of wetland soils and dominance for the majority of the basin by graminoid and shrubby wetland-associated plants and open water. Characteristics were consistent with a complex of 'Swamp, Shrubby, Seasonal, Freshwater (S-S-III-f))', 'Marsh, Graminoid, Semi-permanent, Freshwater (M-G-IV-f)', and 'Shallow open water, Aquatic submersed/floating vegetation, Permanent, Slightly brackish (W-A-V-sb)' pond wetland under the AWCS (ESRD, 2015; Class V Marsh in the Stewart & Kantrud Wetland Classification System, 1971). Classification goes to the deepest part of the wetland - (W-A-V-sb).

The AMWI data incorrectly identified this wetland area as not a wetland, which may be due overlap with the watercourse (Appendix C). The field data indicates a marsh and swamp complex wetland type due to the presence of wetland vegetation indicators of these wetland types. This wetland is part of regional watercourse drainage (Unnamed Tributary to Grande Prairie Creek).

Wetland 9 (Site #105)

This wetland showed soils with evidence of wetland soils and dominance for the majority of the basin by graminoid and shrubby wetland-associated plants. Characteristics were consistent with a complex of 'Swamp, Shrubby, Seasonal, Freshwater (S-S-III-f))', 'Marsh, Graminoid, Seasonal, Freshwater (M-G-III-f)' and 'Marsh, Graminoid, Semi-permanent, Freshwater (M-G-IV-f)' wetland under the AWCS (ESRD, 2015; Class IV Marsh in the Stewart & Kantrud Wetland Classification System, 1971). Classification goes to the deepest part of the wetland - (M-G-IV-f).

The AMWI data identified part of this wetland area as a swamp, but incorrectly identified no marshes (Appendix C). The field data indicates a marsh and swamp complex wetland type due to the presence of wetland vegetation indicators of these wetland types. This wetland is part of regional watercourse drainage (Unnamed Tributary to Grande Prairie Creek).

Wetland 10 (Site #35)

This wetland showed soils with evidence of mottling within 10cm of surface, 80% open water of 1.0m depth, and dominance by graminoid and shrubby wetland-associated plants at the margins. Characteristics were consistent with a 'Shallow open water, Aquatic submersed/floating vegetation, Permanent, Slightly brackish (W-A-V-sb)' pond wetland under the AWCS (ESRD, 2015; Class V in the Stewart & Kantrud Wetland Classification System, 1971).

The AMWI data incorrectly did not include this wetland, but did identify a potential swamp area nearby (Appendix C). The field data indicates a permanent shallow open water submersed/floating aquatic vegetation wetland type due to the presence of wetland vegetation indicators of these wetland types. This wetland does not appear to be directly linked to the regional watercourse drainage (Unnamed Tributary to Grande Prairie Creek).

It is possible this is a dugout, however it was visible in all airphotos, and had an irregular margin back as far as 1950. Confirmation from historical landowners may be able to settle whether or not it is a dugout.

Wetland 11 (Site #28)

This wetland showed soils with evidence of mottling within 20cm of surface, open water above surface, and approximately equal dominance by graminoid and shrubby wetland-associated plants. Characteristics were consistent with a 'Shrubby seasonal swamp mixed with seasonal to semi-permanent graminoid marsh, Aquatic submersed/floating vegetation, Permanent, Slightly brackish (W-A-V-sb)' pond wetland under the AWCS (ESRD, 2015; Class V in the Stewart & Kantrud Wetland Classification System, 1971).

The AMWI data incorrectly did not identify this wetland and did not identify any potential wetland areas nearby (Appendix C). The field data indicates a seasonal to semi-permanent mixed swamp/marsh wetland type due to the presence of wetland vegetation indicators of these wetland types. This wetland does not appear to be directly linked to the regional watercourse drainage (Unnamed Tributary to Grande Prairie Creek).

It is possible this is a dugout, however it was visible in all airphotos, and had an irregular margin back as far as 1950. Confirmation from historical landowners may be able to settle whether or not it is a dugout.

Drainage Features

Wetlands 101, 102, 103, 104 and 105 are part of a multi-pronged regional watercourse drainage feature that feeds downstream into the Unnamed Tributary to Grande Prairie Creek, and thereafter in to the Bear River. Most of this drainage feature exhibits intermittent flows, visible on larger-scale examination of airphotos. It is defined as intermittent watercourse and mapped by Alberta Environment and Parks (AEP; see Figure 5). These linear drainages are 'permanent' in the sense that most of their length contains significant water in all years, and although realignment may be possible with proper planning and sizing of the replacement watercourse channels, these watercourses cannot be infilled/removed without creation of major water management issues. The wetland areas that are noted here as being along the watercourse network are likely to be considered permanent wetlands and may be claimed by the Crown. Realignment of the watercourse channel and infilling of Crown-claimed wetland areas is not possible without purchase of the land from the Crown, which may not be forthcoming.

Watercourse channel realignments in general are governed by the Alberta *Water Act* Approval process, and watercourse crossings are governed under the Alberta *Water Act* Code Of Practice (COP) process. Neither channel realignment(s) nor watercourse crossing location(s) plans are known at this time because

development plans have not yet been defined. Once development plans and locations are known then *Water Act* and/or COP applications for those activities will be required as part of thorough review by AEP.

These riparian and watercourse drainage areas may be suitable and permittable for stormwater management basins, if AEP agrees to this use of the lands. However this activity, if permitted, will incur wetland compensation costs payable to AEP as per the stormwater basin provisions of the AEP Wetland Mitigation Directive (AEP, 2015).

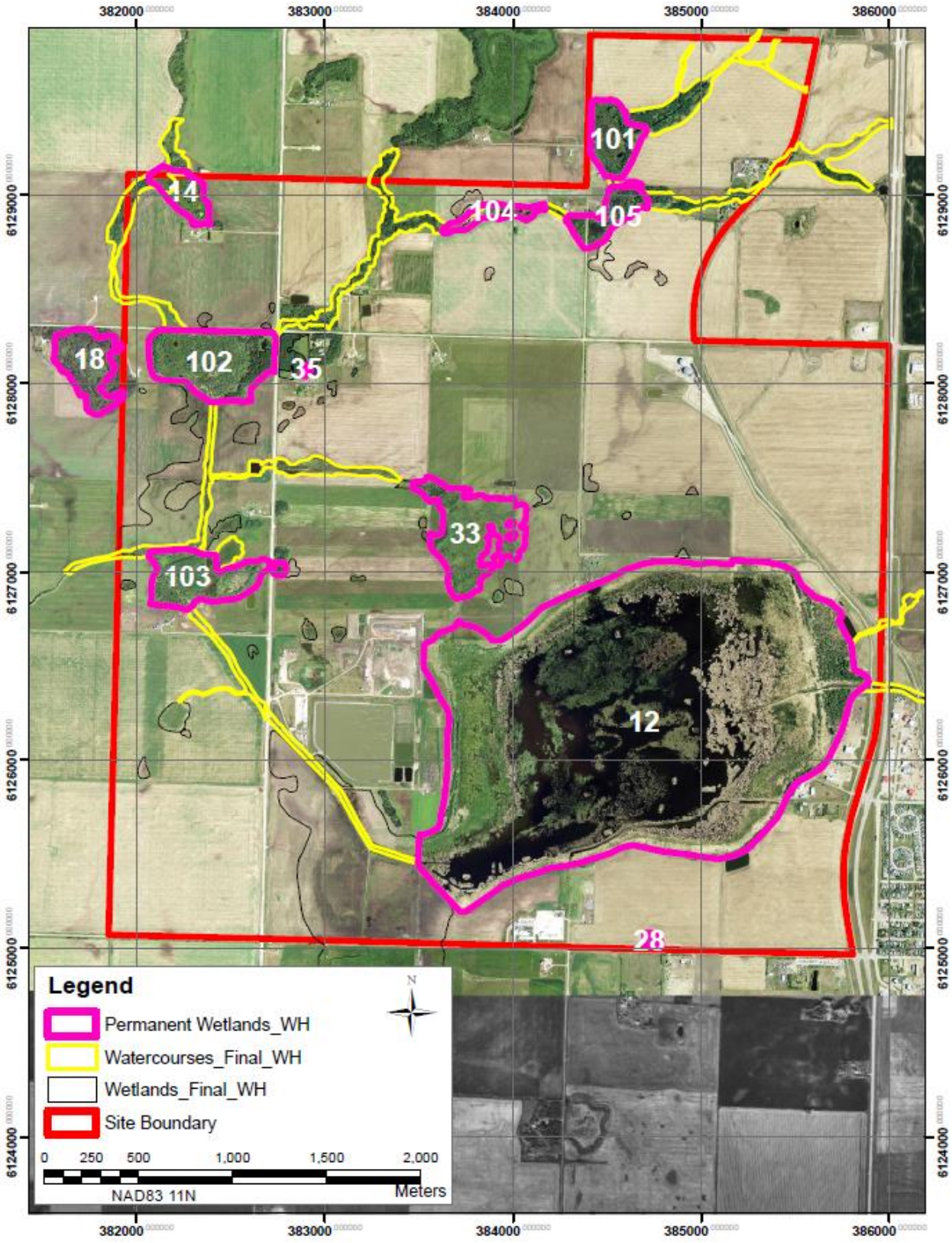

Figure 5. Regional drainage feature watercourse (yellow) and permanent wetlands (pink).

4.3.4 Wetland ABWRET rating

ABWRET ratings for the eleven (11) potentially permanent wetlands were returned from AEP (Table 3). Wetlands marked as '*not yet rated*' are also part of a regional watercourse, and are likely not available to be infilled as they are part of the watercourse area. WSP does not recommend any work in these areas.

4.4 Wetland Permanence

The above information was compiled for each wetland, and reviewed in order to delineate and classify each wetland for purpose of wetland permanence categorization. A table summarizing wetland classification was prepared for AEP review purposes (Table 3; Appendix B).

Table 3. Wetlands in each classification category (ESRD, 2015)

Wetland Class	Total Number of Wetlands	Area (hectares)	Wetland ABWRET 'Quality' rating from AEP
Permanence Class 4	Wetland #14	4.8764	C
	Wetland #18	10.0070	A
	Wetland #33	19.4483	D
	Wetland #102	20.3955	Not yet rated
	Wetland #103	14.0441	Not yet rated
	Wetland #105	6.4385	Not yet rated
	Wetland #28	0.4408	A
	7	*76.2122 total Ha*	-
Permanence Class 5	Wetland #12 (Ferguson Lake)	301.9417	B
	Wetland #35	0.1609	A
	Wetland #101	8.4133	Not yet rated
	Wetland #104	3.2113	Not yet rated
	4	*313.7273 total Ha*	-
Total Wetlands	**11**	**389.9395 Ha**	-

5.0 CONCLUSIONS

There are numerous watercourse drainages throughout the property that all drain together to become an intermittent creek called 'Unnamed Tributary to Grande Prairie Creek'. One lake exists on the property, Ferguson Lake, and this lake is downstream of the larger Clairmont Lake, both of which also drain into the Unnamed Tributary to Grande Prairie Creek. The native shrub and forest areas and wetlands on the property provide a network of habitat connectivity for terrestrial wildlife ecology on the property. No detailed searches for eggs, nests, hibernacula or dens were conducted, however some species of concern have been observed from the area historically – Peregrine falcon and Trumpeter swan. Some tracks were found, and wildlife is expected to use the area for passage.

Eleven (11) potentially permanent wetlands were reviewed in detail for wetlands that occur on the property (Table 3). Classification was based on historical airphoto review, and field surveys for presence of water, water influence on soils, and wetland indicator plants. All these wetlands are potentially Crown-claimable as their deepest portions are classified as Marsh. ABWRET ratings (Table 3) also provide wetland quality rating estimations, which relate to costs for infilling wetlands of quality A, B, C or D. However, some are contiguous with a watercourse and comprise part of the watercourse drainage for an intermittent creek called Unnamed Tributary to the Grande Prairie Creek.

Portions of several of these wetlands are influenced by anthropogenic activities including tilling, crop seeding, grazing, and construction activities.

Loss of wetland function resulting from removal of the site wetlands to allow commercial/industrial development is the proposed development plan. All wetlands discussed in this report are considered potentially claimable by the Crown as permanent bed-and-shore areas, and cannot be developed without specific written approval from the Alberta Government.

6.0 CERTIFICATION OF WORK

This document is intended for the exclusive use of the company, organization, or individual for whom it has been prepared. WSP does not accept responsibility to any third party for the use of information presented in this report, or decisions made or actions taken based on its content.

The information presented in this report is based on, and limited by, the circumstances and conditions acknowledged herein, and on information available at the time of its preparation. WSP has exercised reasonable skill, care, and diligence to assess the information acquired during the preparation of this report, but cannot guarantee or warrant the accuracy or completeness of the information. Information provided by others, whether represented or otherwise utilized, is believed to be accurate but cannot be guaranteed.

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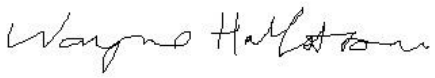

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7.0 REFERENCES

Achuff, P. 1994. Natural regions, subregions and natural history themes of Alberta: A classification for protected areas management. Prepared for Parks Services, Alberta Environmental Protection. Edmonton, Alberta, Canada.

Alberta Agriculture and Forestry and Alberta Environment and Parks (AAF and AEP), 2016. Current and Historical Alberta Weather Station Data Viewer. http://agriculture.alberta.ca/acis/alberta-weather-data-viewer.jsp

Alberta Agriculture and Rural Development. 2016. Alberta Soil Information Viewer. Available at: http://www1.agric.gov.ab.ca/$department/deptdocs.nsf/all/sag10372. Accessed September, 2016.

Alberta Environment. 2014. Alberta Merged Wetland Inventory. ArcInfo coverage GIS mapping file, from Alberta Environment.

Alberta Environment and Parks (AEP). 2015. Alberta Wetland Mitigation Directive. Water Policy Branch, Alberta Environment and Parks, Edmonton, Alberta, 11pp.

Alberta Environment and Parks (AEP). 2016a. Landscape Analysis Tool. http://aep.alberta.ca/forms-maps-services/industry-online-services/landscape-analysis-tool/landscape-analysis-tool.aspx Accessed September, 2016.

Alberta Environment and Parks (AEP). 2016b. Guide for assessing permanence of wetland basins. Land and Forestry Policy Branch, Policy Division. January 2016. 20pp.

Alberta Environment and Sustainable Resource Development (ESRD). 2015. Alberta Wetland Classification System. Water Policy Branch, Policy Division, Edmonton, Alberta. 38pp.

Alberta Conservation Information Management System (**ACIMS) 2015.** Species of special concern. Alberta Environment and Parks. (formerly Alberta Natural Heritage Information Center [ANHIC]). http://www.cd.gov.ab.ca/preserving/parks/anhic/flashindex.asp Accessed September, 2016.

Beckingham, J.D. and J.H. Archibald. 1996. Field guide to ecosites of northern Alberta. Special Report 5, Canadian Forest Service, Northwest Region, Northern Forestry Center. UBC Press, Vancouver.

Environment Canada. 2015. Canadian climate normals 1961-2010 – Prairie Provinces. Atmospheric Environmental Services, Environment Canada. Ottawa, Ontario, Canada.

Fish and Wildlife Management Information System (FWMIS). 2015. Alberta Fish and Wildlife and Alberta Conservation Association. (formerly Biodiversity/ Species Observation Database **-** BSOD). http://www3.gov.ab.ca/srd/fw/guidres/bsod.html Accessed September, 2016.

Halsey LA, DH Vitt, D Bellman, S Crow, S Mehelcic and R Wells. 2003. Alberta Wetland Inventory Classification System – Version 2.0. April 2004, Alberta Sustainable Resource Development. 118pp.

National Wetlands Working Group. 1988. Wetlands of Canada. Ecological Land Classification series No.24. Sustainable Develoipment Branch, Environment Canada, Ottawa, Ontario and Polyscience Publications Inc., Montreal, Quebec.

National Wetlands Working Group. 1997. The Canadian wetland classification system: A revision of the wetlands of Canada. Edited by B.G. Warner and C.D.A. Rubec. Wetlands Research Center, University of Waterloo, ON.

Natural Regions Committee. 2006. Natural regions and subregions of Alberta. Compiled by D.J. Downing and W.W. Pettapiece. Government of Alberta, Publication No. T/852.

Stewart, R.E. and H.A. Kantrud. 1971. Classification of Natural Ponds and Lakes in the Glaciated Prairie Region. Resource publication 92, Bureau of Sport Fisheries and Wildlife, US Fish and Wildlife Service, Washington, DC. (see the Northern Prairie Wildlife Research Center Home Page).

Tiner, R.W. 1999. Wetland Indicators: A Guide to Wetland Identification, Delineation, Classification, and Mapping. Lewis Publishers, New York. 424 Pages.

Wetland Training Institute. 1987. Field Guide for Wetland Delineation: 1987 Corps of Engineers Manual**.** 144 Pages.

APPENDICES

Appendix A.	Airphotos Used For Historical Wetland Delineation.
Appendix B.	Multiple Wetland Assessment Table
Appendix C.	Alberta Merged Wetland Inventory
Appendix D.	Regional Soils Data Review
Appendix E.	Fisheries and Wildlife Management Information system (FWMIS) Database Site Records.
Appendix F.	Vegetation Species Observed June and August 2015
Appendix G.	Alberta Conservation Information Management System (ACIMS) Database Site Records.

APPENDICES WERE REMOVED TO MAKE THE REPORT SMALLER FOR DISTRIBUTION.

See associated secondary document.